III. REMARKS

1. Claims 1, 2, 6-20, 24-29, 31-35, 37-43, and 54-57 remain in the application.

Claims 3-5, 21-23, 30, 36 and 44-53 have been cancelled without prejudice.

Claims 58 and 59 are new.

Claims 1, 2, 6, 19, 20, 24-29, 31-35, 41-43, and 54-57 have been amended.

2. Applicants appreciate the indication that claims 10, 12, 16-18, 28, 31, 34 and 35 would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims. However, Applicants believe that these claims are patentable as they stand for the reasons stated below.

3. Applicants respectfully submit that claims 1, 2, 4-9, 11, 13-15, 19, 20, 22-27, 29, 32, 33, 42-50, and 52-57 are not anticipated by Kim et al. ("A Deblocking Filter with Two Separate Modes in Block-Based Video Coding") under 35 USC 102(a), and are not anticipated by Kim (GB 2 329 090) under 35 USC 102 (b).

Independent method claim 1 has been amended to read as follows:

"A method for reducing visual artefacts due to block boundaries between decoded image blocks in a frame of a digital video signal, comprising performing an adaptive block boundary filtering operation on a block boundary that

exists between a first decoded image block on a first side of the block boundary and a second decoded image block on a second side of the block boundary, the first decoded image block having been encoded using a first encoding method and the second decoded image block having been encoded using a second encoding method, wherein the method comprises determining a value of at least one parameter of the adaptive block boundary filtering operation to be performed on the block boundary by examination of the first and second encoding methods."

Support for the amendment *"....determining a value of at least one parameter of the adaptive block boundary filtering operation to be performed on the block boundary by examination of the first and second encoding methods"* can be found from paragraphs 0045 and 0046 of the US patent publication for the present application (US 2001/0017944 A1), as well as Table 1.

Corresponding amendments have been made to the other independent claims and the language of the dependent claims has been adapted in view of the new amendments.

The Applicant will first discuss the Examiner's rejection of claims 1, 2, 4 - 9, 11, 13-15, 19, 20, 22-27, 29, 32, 33, 42-50 and 52-57 under 35 U.S.C. 102(a) with respect to Kim et al. ("A Deblocking Filter with Two Separate Modes in Block-Based Video Coding"), and the corresponding rejections of the same claims under 35 U.S.C. 102(b) with respect to Kim (GB 2 329 090). As the two cited documents refer to essentially similar block boundary filtering methods, both

these rejections will be addressed together to avoid unnecessary repetition.

Considering first the Kim patent (GB 2 329 090), as stated in the Applicant's response to the Official Action issued on 22nd October 2004, this relates to a method for removing blocking artefacts that arise in digitally coded video pictures due to the fact that images are divided into discrete image blocks which are encoded independent of each other (GB 2 329 090, page 2, line 20 to page 3, line 2).

The method disclosed in GB 2 329 090 has two modes of operation, one referred to as "default" mode, the other referred to as "DC offset mode". The passage of text between page 5, lines 3 and 11 describes, at a general level, how a filtering mode (either default or DC offset mode) is selected for a block boundary. In particular, it is stated that selection of the default mode or DC offset mode is performed "based on **an amount of blocking artefacts**" (page 5, lines 5 to 7), the "amount of blocking artefacts" being determined by examination of **pixel value differences within adjacent image blocks and across the boundary between the adjacent image blocks** (page 12, lines 5 to 11 with reference to Figure 2). It is evident that, according to GB 2329090, the DC offset mode of operation is chosen when the difference in pixel values within / between adjacent blocks is comparatively small, i.e. when it is desired to remove blocking artefacts in a "smooth" region of an image (page 11, lines 5 to 8, page 12, lines 5 to 11). The default mode of operation is chosen in other situations (page 12, line 11).

In contrast to Kim, the independent claims of the present application as newly amended define performing an adaptive block boundary filtering operation by "....**determining a value of at least one parameter of the adaptive block boundary filtering operation to be performed on the block boundary by examination of the first and second encoding methods**."

It should be noted that the first and second encoding methods referred to in this statement of the claim are respectively the encoding method that was used to encode a decoded image block on a first side of the block boundary to be filtered and the encoding method that was used to encode a decoded image block on a second side of the block boundary in question. The pre-amble portion of the claim has been amended accordingly to provide a clearer definition of the intended meaning of the first and second "encoding methods".

In passing, it should be noted that use of the terms "first" and "second" encoding methods in the claims does not in any way preclude the situation in which the first and second encoding methods are the same. For example, decoded image blocks on either side of a block boundary to be filtered may both have been encoded using an INTRA coding method (See Table 1 on page 4 of US 2001/0017944 A1 for examples of possible combinations of encoding methods that can exist across a block boundary).

In point 11 of the present Official Action, the Examiner cites Figure 4 of the Kim patent (in particular blocks 405, 406 and 408 - 410) as disclosing a deblocking filter that performs a filtering operation that is dependent at least in

part on an encoding method used. However, it is the Applicant's view that the Kim patent does not disclose, neither does it suggest in any way, that **a value of at least one parameter of the adaptive block boundary filtering operation to be performed on the block boundary is determined by examination of the first and second encoding methods** as stated by the newly amended claims.

It should be emphasised that although the filtering operation applied in Kim's DC offset mode (illustrated in blocks 407 - 410 of Figure 4) involves the parameter QP which, according to Kim page 6, lines 1 & 2 "is the quantisation parameter of a block adjacent to the block boundary", i.e. a parameter of the encoding method applied to an image block whose boundary is being filtered, in Kim the encoding methods used to encode image blocks on either side of the block boundary are not examined and therefore cannot play a role in the determination of parameter values used in the default or DC offset filtering modes.

On the contrary, Kim teaches that filtering according to either the default mode or DC offset mode is performed "based on **an amount of blocking artefacts**" (GB 2 329 090, page 5, lines 5 to 7), the "amount of blocking artefacts" being determined by examination of **pixel value differences within adjacent image blocks and across the boundary between the adjacent image blocks** (page 12, lines 5 to 11 with reference to Figure 2). Therefore, to re-iterate, the block boundary filtering method presented in the Kim patent does not involve examination of a first encoding method that was used to encode a decoded image block on a first side of the block boundary and examination of a second encoding method

that was used to encode a second decoded image block on a second side of the block boundary in order to determine a value of at least one parameter of the adaptive boundary filtering operation to be performed on the block boundary, as claimed in the present application.

It is therefore the Applicant's view that the Kim patent cannot form the basis of a rejection under 35 U.S.C 102(b) and respectfully requests the Examiner to reconsider his rejection with reference to the newly amended claims.

The same arguments as those presented in connection with the Kim patent apply in equal measure to Kim's scientific article: "A Deblocking Filter with Two Separate Modes in Block-Based Video Coding". As stated earlier, both the patent and the scientific article relate to essentially similar block boundary filtering methods. More specifically, the block boundary filtering method presented in Kim's scientific article operates by selecting a filtering mode to be applied to a block boundary based on an assessment of pixel value differences within or between adjacent image blocks.

Just like the block boundary filtering method introduced by the Kim patent, the block boundary filtering method presented in Kim's scientific article does not involve examination of a first encoding method that was used to encode a decoded image block on a first side of the block boundary and examination of a second encoding method that was used to encode a second decoded image block on a second side of the block boundary in order to determine a value of at least one parameter of the adaptive boundary filtering

operation to be performed on the block boundary. It is therefore the Applicant's view that Kim's scientific article cannot anticipate the newly amended claims under U.S.C 102(a) and respectfully requests the Examiner to reconsider his claim rejections.

4. Applicants respectfully submit that claims 1, 2, 4-9, 11, 13-15, 19, 20, 22-27, 29, 32, 33, 42-50, and 52-57 are not anticipated by Itoh (US 6,608,865) under 35 USC 102(e).

Turning now to the Itoh patent, US 6,608,865, this discloses a method of block-based video coding in which the coding efficiency of DCT transform coefficients is improved by taking into account directionality information within image blocks.

As explained in column 3, between lines 1 and 64 (and as well-known to the skilled person in video coding), a conventional block-based video encoder applies a discrete cosine transform (DCT) to an image block, thereby transforming a block of pixel values into a matrix of horizontal and vertical spatial frequency components known as DCT coefficients (column 3, lines 3 to 20). It is also well-known that most energy is concentrated in the low frequency components i.e. those DCT coefficients grouped near the upper left-hand corner of the matrix have the largest values (see Figure 2). Taking this fact into account, the DCT coefficients are quantized using an array of quantization values (see Figure 3), such that higher frequency components tend to be quantized to zero (column 3, lines 49 to 55). It is acceptable to do this since the human

visual system is less sensitive to high spatial frequencies than it is to lower frequencies.

The DCT coefficients are then scanned in rising order of spatial frequency (so-called zig-zag scanning) to produce an ordered sequence of coefficients. The ordered sequence is then coded using a statistical coding method, for example variable-length coding (VLC) (column 3, lines 55 to 64 and column 4, lines 22 to 48). Ordering of the DCT coefficients in ascending order of spatial frequency has the effect that the higher frequency DCT components, which tend to have zero values, become grouped together at the end of the ordered sequence. This means that a significant coding gain can be achieved when variable length coding is applied.

The coding method introduced by Itoh proposes altering the zig-zag scanning order of the DCT coefficients to take into account directionality within image blocks e.g. due to the presence of edges within an image. As explained in column 4, between lines 4 and 16, the direction of an edge within an image block has a high correlation with the corresponding DCT coefficients in the DCT coefficient matrix. For example, it is well known that when an image block contains a vertical edge, corresponding DCT coefficients with relatively large magnitude appear in the horizontal direction. This situation is illustrated in Figure 4 (type B edge), as are the distributions of DCT coefficients for horizontal (type A) and diagonal (type C) edges.

In more detail, the coding method proposed by Itoh, works by extracting edge information from an image block (column 5, lines 32 to 50), classifying the block into one of a number

of directionality classes according to the directionality of the identified edge (column 5, line 51 to column 6, line 2) and then scanning the DCT coefficients of the block in a manner that is related to the classification of the block (column 6, lines 8 to 10). The effect of this adaptive scanning procedure is to produce a shorter scanning path, which leads in turn to improved data compression when statistical coding (e.g. variable-length coding) is applied (column 4, lines 59 to 67).

As explained above, the coding method presented by Itoh is directed towards improving the coding gain of variable length coding applied to DCT coefficients by adapting the scanning order of the DCT coefficients.

The Applicant would like to re-iterate that Itoh's method **does not** relate to a "**method for reducing visual artefacts due to a block boundaries between image blocks**", as claimed in the present application, but rather to a method for improving the efficiency with which DCT coefficients can be encoded.

Firstly, it should be appreciated that Itoh does not relate to any form of filtering operation, but to a method for encoding DCT coefficients with improved efficiency, in which a scanning order of the coefficients is adapted according to the directionality of edges within an image block.

Secondly, even if an unjustifiably broad interpretation of the word "filtering" is taken in which, contrary to the skilled persons understanding, the meaning of the word "filtering" is extended in such a way that it includes scanning of the DCT coefficients, it is clear that the

"edges" referred to by Itoh **are not** boundaries **between image blocks**, introduced because of the essentially "artificial" division of the image into blocks for coding purposes, but **real features** of the image that occur **within image blocks**.

In order to clarify these fundamental differences, the Applicant has amended each of the independent claims that stands rejected to include a statement that:

"....**an adaptive block boundary filtering operation**" is performed "**on a block boundary that exists between a first decoded image block on a first side of the block boundary and a second decoded image block on a second side of the block boundary**".

It is the Applicant's view that this form of words distinguishes the newly amended claims from Itoh by defining in a clear and unequivocal manner that the present invention relates to **an adaptive block boundary filtering operation** and that the boundary in question is not an **edge** which is a real feature of the image within an image block, but is a **boundary** that exists between first and second image blocks.

The Applicant would also like to emphasise that Itoh's coding method has nothing to do with reducing visual artefacts. It is simply concerned with improving the encoding efficiency of DCT coefficients. In fact, since it is Itoh's intention to reduce the amount of information required to represent the DCT coefficients of image blocks, the skilled person might expect there to be a deterioration in image quality as a result of applying Itoh's method. However, referring to the paragraph of Itoh's patent which starts at line 59 of column 4 and ends at line 5 of column

5, Itoh it is explained that "....**the adaptive scanning scheme does not affect image quality**....". So, far from Itoh being a method for reducing visual artefacts, Itoh himself realises that there could be concerns that his method would lead to deterioration in image quality (i.e. an increase in visual artefacts) and feels it necessary to explain that no such deterioration takes place.

The Applicant would also like to point out that Itoh does not disclose, nor does he suggest **determining a value of at least one parameter of the adaptive block boundary filtering operation to be performed on the block boundary by examination of the first and second encoding methods,** where the first and second encoding methods are respectively a first encoding method that was used to encode a first decoded image block on a first side of the block boundary and a second encoding method that was used to encode a second decoded image block on a second side of the block boundary, as defined earlier in the claim. More specifically, when determining a DCT coefficient scanning order for a particular image block, Itoh only considers the image block in question and does not determine any parameter by examining an encoding method used to encode a first decoded image block and an encoding method used to encode a second decoded image block.

In summary, therefore, Itoh's patent:

1). does not relate to reducing visual artefacts;

2). does not disclose an adaptive block boundary filtering operation; and

3). does not determine a value of a parameter of an adaptive block boundary filtering operation by examination of a first and a second encoding method.

For all of the above reasons, it is the Applicant's view that the coding method presented by Itoh cannot be used as the basis for a rejection of the claims under 35 U.S.C. 102(e) and respectfully requests the Examiner to reconsider his rejections based in Itoh in the light of the newly made claim amendments.

5. Applicants respectfully submit that claims 41 and 51 are patentable over Kim et al. and over Kim under 35 USC 103(a).

Claim 51 has been cancelled. Claim 41 includes subject matters similar to claim 1 and is patentable for all the reasons argued above.

6. Applicants respectfully submit that claims 41 and 51 are patentable over Itoh under 35 USC 103(a).

Claim 51 has been cancelled as mentioned above and claim 41 is patentable for all the reasons argued above with respect to claim 1.

For all of the foregoing reasons, it is respectfully submitted that all of the claims now present in the application are clearly novel and patentable over the prior art of record, and are in proper form for allowance.

Accordingly, favorable reconsideration and allowance is respectfully requested. Should any unresolved issues remain, the Examiner is invited to call Applicants' attorney at the telephone number indicated below.

A check in the amount of $2,210.00 is enclosed for the RCE fee, a three (3) month extension of time, and for the additional claims.

The Commissioner is hereby authorized to charge payment for any fees associated with this communication or credit any over payment to Deposit Account No. 16-1350.

Respectfully submitted,

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